

REMARKS

In the Office Action dated July 22, 2005, claims 5 and 18 were rejected under 35 U.S.C. § 112, ¶ 2; claims 1-13 and 15-17 were rejected under § 102 over U.S. Patent No. 5,686,349 (Nakata); and claims 14 and 18 were rejected under § 103 over Nakata.

Claims 5 and 18 have been amended to address the § 112 rejection.

It is respectfully submitted that amended claim 1 is not anticipated by Nakata. Amended claim 1 recites a method of forming a microcrystalline thin film that comprises:

- supplying, during a first process, a first gas and a second gas to a chamber in which a substrate is located;
- supplying, during a second process, the second gas but not the first gas to the chamber;
- depositing the microcrystalline thin film during the second process; and
- performing the first process and second process a plurality of times to form the microcrystalline thin film on the substrate.

Note that claim 1 now recites depositing the microcrystalline thin film during the second process. In contrast, Nakata teaches deposition of a silicon layer on the substrate during the first time period in which the material gas and hydrogen gas are introduced. Nakata, 5:45-58. On the other hand, during the period in which only the hydrogen gas is introduced, the silicon layer that *has been deposited* on the substrate 10 is subjected to a hydrogen plasma treatment to convert the deposited amorphous silicon layer into a microcrystalline layer. Nakata, 5:58-61; 6:26-28; 7:18-20.

Clearly, Nakata does not teach depositing a microcrystalline thin film on a substrate during the second time period – Nakata specifically teaches that during this second time period, the hydrogen plasma treatment is performed to convert the amorphous silicon layer to a microcrystalline silicon layer. Therefore, amended claim 1 is not anticipated by Nakata.

Newly added independent claim 29 is also distinguishable over Nakata. Claim 29 recites supplying a first gas and second gas to a chamber in which a substrate is located, and depositing the microcrystalline thin film on the substrate, where prior to depositing the microcrystalline thin film, the supply of the first gas to the chamber is stopped. In contrast, in Nakata, depositing of

the silicon layer is performed during the first time period in which the material gas and hydrogen gas are being introduced.

Amended independent claim 9 is also allowable over Nakata. Claim 9 recites a method of forming a microcrystalline thin film by activating a first source gas containing an element that forms a polymer when a plurality of molecules of the element are bonded in a vapor phase, and forming a film having a microcrystalline structure primarily composed of the element on a film forming target object, wherein activating the first source gas comprises applying an electric field to break down the first source gas to a second gas.

The Office Action conceded that Nakata fails to teach converting SiH<sub>4</sub> to SiH<sub>2</sub>, 7/22/2005 Office Action at 3. However, the Office Action pointed to a discussion in the Background section of the present specification (on page 3) as providing an admission that Nakata applies such an electric field to break down SiH<sub>4</sub> to SiH<sub>2</sub>. *Id.* The reference to the specification on page 3 of the present application in the context of a § 102 rejection based on Nakata is clearly improper. The Office Action has failed to establish how the discussion in the Background section of the present application has any relevance to Nakata. Page 3 of the present specification refers to irradiating source gas SiH<sub>4</sub> using a plasma CVD method to break down to *less reactive SiH<sub>3</sub>* before forming a film. This passage on page 3 of the specification has no relevance to the technique described in Nakata. Moreover, Applicant notes that the Office Action has even misquoted the Background section of the present specification by stating that the specification teaches that SiH<sub>4</sub> is broken down into more reactive SiH<sub>2</sub> – that is clearly not what page 3 of the present specification, at lines 5-7, describes. The referenced passage describes the breakdown of SiH<sub>4</sub> to *less reactive SiH<sub>3</sub>*.

Moreover, Nakata specifically teaches that SiH<sub>4</sub> is used to form the amorphous silicon layer. There is absolutely no teaching or implication anywhere within Nakata that the SiH<sub>4</sub> gas is converted to any other form of gas prior to forming the amorphous silicon layer. Therefore, clearly, Nakata does not anticipate the subject matter of claim 9.

Dependent claims (including newly added dependent claims 26-28 and 30) are allowable for at least the same reasons as corresponding independent claims.

It is respectfully submitted that the observations made in the Office Action with respect to dependent claims 4-8, 13, and 16 are also erroneous. However, based on the amendments of independent claims 1 and 9, the rejections of these claims have been overcome.

Moreover, the subject matter of dependent claim 26 is distinguished from Nakata in that Nakata does not teach supplying of first gas and second gas during the first process at rates that define a ratio to prevent a thin film on the substrate from becoming amorphous. In contrast, Nakata teaches that during a first predetermined period, a material gas and hydrogen gas are introduced into a reaction chamber 30 such that an *amorphous* silicon layer is formed. *See, e.g.*, Nakata, 4:22-25; 5:45-47; 7:4, 15-20. As taught by Nakata, because the amorphous silicon layer is formed during the first predetermined time period, hydrogen has to be supplied during a second period to perform hydrogen plasma treatment to *convert* the *amorphous* silicon layer into a microcrystalline layer. *See, e.g.*, Nakata, 4:26-28; 5:48-50, 61-64; 6:26-28; 7:18-20. Therefore, it is respectfully submitted that the process performed by Nakata is very different from the process recited in claim 26. Claim 26 is thus not anticipated by Nakata for this additional reason. Also, dependent claim 28 is similarly not anticipated by Nakata.

With respect to the obviousness rejection of claim 14, it is respectfully submitted that a *prima facie* case of obviousness has not been established with respect to claim 14. Although the Office Action conceded that Nakata fails to disclose performing a source supplying process for two seconds or less, the Office Action nevertheless stated that claim 14 would be obvious. Nakata does not provide any suggestion of performing a source supplying process for two seconds or less. If a reference exists that suggests the modification of Nakata to achieve the claimed invention, it is respectfully submitted that the Office Action produce such a reference. Absent this requisite reference, a *prima facie* case of obviousness has not been established with respect to claim 14.

It is respectfully submitted that the obviousness rejection of claim 18 has been overcome based on the amendment of claim 9.

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In view of the foregoing, allowance of all claims is respectfully requested. The Commissioner is authorized to charge any additional fees and/or credit any overpayment to Deposit Account No. 20-1504 (CMO.0012US).

Respectfully submitted,

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